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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2018-1015; Special Conditions No. 25-746-SC]

Special Conditions: Boeing Model 777-9 Airplane; Tire Debris Penetration of Fuel Tank Structure.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for The Boeing Company (Boeing) Model 777-9 airplane. This airplane will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport category airplanes. This design feature is composite fuel tanks that may be subject to tire-debris penetration of the fuel tanks. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: This action is effective on Boeing on [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Send comments on or before [INSERT DATE 45 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: Send comments identified by Docket No. FAA-2018-1015 using any of the following methods:

- *Federal eRegulations Portal:* Go to <http://www.regulations.gov/> and follow the online instructions for sending your comments electronically.
- *Mail:* Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, DC, 20590-0001.
- *Hand Delivery or Courier:* Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Fax:* Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://www.regulations.gov/>, including any personal information the commenter provides. Using the search function of the docket Web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the *Federal Register* published on April 11, 2000 (65 FR 19477-19478).

Docket: Background documents or comments received may be read at <http://www.regulations.gov/> at any time. Follow the online instructions for accessing the docket or go to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Suzanne Lucier, Propulsion and Mechanical Systems Section, AIR-672, Transport Standards Branch, Policy and Innovation Division, Aircraft Certification Service, Federal Aviation Administration, 2200 South 216th Street, Des Moines, Washington 98198; telephone and fax 206-231-3173; e-mail suzanne.lucier@faa.gov.

SUPPLEMENTARY INFORMATION: The substance of these special conditions has been published in the *Federal Register* for public comment in several prior instances with no substantive comments received. Therefore, the FAA has determined that prior public notice and comment are unnecessary, and finds that, for the same reason, good cause exists for adopting these special conditions upon publication in the *Federal Register*.

Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On March 12, 2015, Boeing applied for an amendment to Type Certificate No. T00001SE to include the new 777-9 airplane. This airplane, which is a derivative of the Boeing Model 777 airplane currently approved under Type Certificate No. T00001SE, is a twin-engine, transport category airplane with seating for 495 passengers and a maximum takeoff weight of 775,000 pounds.

Type Certification Basis

Under the provisions of title 14, Code of Federal Regulations (14 CFR) 21.101, Boeing must show that the 777-9 airplane meets the applicable provisions of the regulations listed in Type Certificate No. T00001SE, or the applicable regulations in effect on the date of application for the change, except for earlier amendments as agreed upon by the FAA.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Boeing Model 777-9 airplane because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design feature, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the Boeing Model 777-9 airplane must comply with the fuel-vent and exhaust-emission requirements of 14 CFR part 34, and the noise-certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under § 21.101.

Novel or Unusual Design Features

The Boeing Model 777-9 airplane will incorporate the following novel or unusual design feature:

Composite fuel tanks that may be subject to tire-debris penetration of the fuel tanks.

Discussion

Accidents or incidents have resulted from uncontrolled fires caused by fuel leaks due to fragments of tires or uncontained engine failure penetrating or rupturing the undersides of airplane wings. The effects of engine debris as a result of uncontained engine failure are not included in these special conditions because, for the Boeing Model 777-9 airplane, this hazard is addressed under the existing requirements of § 25.903(d), which requires minimizing the hazards from uncontained engine-failure debris.

In one incident in Honolulu, Hawaii, a tire on a Boeing Model 747 airplane burst, and tire debris penetrated a fuel-tank access panel, causing a substantial fuel leak. Takeoff was aborted and passengers were evacuated down the emergency chutes into pools of fuel, which fortunately had not ignited. This accident highlighted deficiencies in the then-existing 14 CFR part 25 regulations pertaining to fuel-tank fuel retention following tire fragments penetrating fuel tanks.

After a subsequent Boeing Model 737 airplane accident in Manchester, England, in which uncontained engine-failure debris penetrated a fuel-tank access panel, the FAA amended § 25.963 to require that fuel-tank access panels be resistant to penetration from both tire-failure debris and uncontained engine-failure debris. Section 25.963(e) requires showing, by analysis or tests, that fuel-tank access covers "... minimize penetration and

deformation by tire fragments, low energy engine debris, or other likely debris.”

Advisory Circular (AC) 25.963-1, “Fuel Tank Access Covers,” defines the region of the wing that is vulnerable to impact damage from these sources, and provides a method to substantiate that the rule has been met for tire fragments. No specific requirements were established for the contiguous wing areas into which the fuel-tank access covers are installed, because of the inherent ability of conventional aluminum wing skins to resist tire-debris penetration. Advisory Circular 25.963-1 specifically notes, “The [fuel-tank] access covers, however, need not be more impact resistant than the contiguous tank structure,” highlighting the assumption that the basic structures of these wings meet some higher standard. An additional amendment to 14 CFR part 121 required operators to modify their existing fleets of airplanes with impact-resistant fuel-tank access panels. This amendment only addressed fuel-tank access panels because service experience at the time indicated that the wing skin on the underside of a wing, on conventional, subsonic airplanes, provided adequate, inherent capability to resist tire debris and engine debris penetration.

However, after the adoption of the amendments to § 25.963 in 2000, an unanticipated failure mode occurred on a Concorde airplane when tire debris impacted the fuel tank. The initial impact of the tire debris did not penetrate the fuel tank, but a pressure wave from the debris impact caused the fuel tank to rupture. In September 2001, both the French civil-aviation authority (DGAC) and the United Kingdom Civil Aviation Authority (CAA) issued airworthiness directives requiring modifications to Concorde airplanes, to add a means to retain fuel if the primary fuel retention means was damaged.

To maintain the level of safety envisioned by § 25.963(e), these special conditions establish a standard for resistance to potential tire-debris impacts to the contiguous wing surfaces, and require consideration of possible secondary effects of a tire impact, such as the induced pressure wave that was a factor in the Concorde accident. This standard takes into account that new construction methods and materials may not necessarily provide the resistance to debris impact that historically has been shown as adequate with conventional aluminum wings. These special conditions are based on the defined tire-impact areas and tire-fragment characteristics described in AC 25.963-1.

In addition, despite practical design considerations, some uncommon debris larger than that defined in paragraph (b) of these special conditions may cause a fuel leak within the defined area, so paragraph (c) of these special conditions also takes into consideration possible fuel-leak paths. Fuel-tank surfaces of typical transport airplanes have thick aluminum construction in the tire-debris impact areas that is tolerant to tire debris larger than that defined in paragraph (b) of these special conditions. Consideration of leaks caused by larger tire fragments is needed to ensure that an adequate level of safety is provided where composite material is used.

These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

Applicability

As discussed above, these special conditions are applicable to the Boeing Model 777-9 airplane. Should Boeing apply at a later date for a change to the type certificate to

include another model incorporating the same novel or unusual design feature, these special conditions would apply to that model as well.

Conclusion

This action affects only a certain novel or unusual design feature on one model of airplane. It is not a rule of general applicability.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

Authority Citation

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for Boeing Model 777-9 airplanes.

(a) Tire-debris impact to any fuel tank or fuel-system component, located within 30 degrees to either side of wheel rotational planes, may not result in penetration or otherwise induce fuel-tank deformation, rupture (e.g., through propagation of pressure waves), or cracking sufficient to allow a hazardous fuel leak. A hazardous fuel leak results if debris impact to a fuel-tank surface causes –

1. A running leak,
2. A dripping leak, or
3. A leak that, 15 minutes after wiping dry, results in a wetted airplane surface exceeding 6 inches in length or diameter.

The leak must be evaluated under maximum fuel head pressure.

(b) Compliance with paragraph (a), above, must be shown by analysis or tests assuming all of the following. The tire-debris fragment:

1. Size is 1 percent of the tire mass.
2. Is propelled at a tangential speed that could be attained by a tire tread at the airplane flight-manual airplane rotational speed (V_R at maximum gross weight).
3. Load is distributed over an area on the fuel-tank surface equal to 1.5 percent of the total tire tread area.

(c) Fuel leaks caused by impact from tire debris larger than that specified in paragraph (b), from any portion of a fuel tank located within the tire-debris impact area defined in paragraph (a), may not result in hazardous quantities of fuel entering any of the following areas of the airplane:

1. Engine inlet,
2. APU inlet, or
3. Cabin-air inlet.

This must be shown by test or analysis, or a combination of both, for each approved engine forward-thrust condition, and each approved reverse-thrust condition.

Issued in Des Moines, Washington, on May 13, 2019.

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Policy and Innovation Division,
Aircraft Certification Service.

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